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Disease-Resistant Apple Cultivars Developed from the Apple Breeding Program at the University of Illinois

S.S. Korban and P.A. O'Connor

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Agricultural Experiment Station—College of Agriculture—University of Illinois at Urbana-Champaign.

MAJOR DISEASES OF THE APPLE

Apple diseases can seriously reduce yields and marketability of fruit. The most serious disease in both commercial orchards and home gardens is apple scab, caused by the fungus *Venturia inaequalis* (Cke.) Wint. Scab, which thrives in the cool, humid conditions of spring in the Midwest and attacks the foliage and fruit of the apple tree. Early infection of leaves causes severe defoliation and weakens the tree, resulting in poor fruit set for the following season. Infection of immature fruits causes heavy fruit drop, reducing yield. Brownish black scabby patches result in malformed apples with lowered quality grade. This condition prohibits marketing the apples while they are fresh and reduces their storage potential due to rapid moisture loss through the lesions.

Cedar-apple rust caused by the fungus *Gymnosporangium juniperi-virginianae* Schw. is also a serious apple disease. The swollen lesions and fruiting bodies associated with this disease can affect leaves, twigs, and fruits. Rust weakens the tree, reducing yield and fruit quality. Infected fruits are rendered unsalable.

Powdery mildew caused by the fungus *Podosphaera leucotricha* (Ell. & Ev.) Salm. is another serious disease of apples. Infected leaves and shoots develop a white powdery mass of mycelia on their surface, resulting in overall stunting of shoot growth. Mildew may also attack flower buds, resulting in a failure to produce blossoms. Highly susceptible apple cultivars may also show infection on the fruit. Infected fruits may remain small in size, are sometimes deformed, and have a roughened surface. Usually mycelial infection changes to russetting as the fruit matures.

Finally, fire blight is a very serious bacterial disease caused by *Erwinia amylovora* (Burr.) Winslow et al. Apple leaves and blossoms attacked by fire blight wilt and turn black as if they are scorched.

Shoots and branches die, curling into a typical "shepherd's crook" at the tip.

To prevent these losses, a grower would need to apply fungicides 12 to 15 times during the growing season, incurring the increased expense of fungicide, spray equipment, and labor costs. Planting disease-resistant apple cultivars significantly reduces grower costs by eliminating fungicide sprays. Recently, public concern over the environmental and health hazards posed by excessive chemical spraying has made disease-resistant apple cultivars and integrated pest management imperative to a successful apple industry. NOV 11 1996

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Early in this century, the apple fruit breeding program was initiated at the University of Illinois. Hundreds of crosses were made, including crosses between small-fruited crabapple types and large-fruited apples. One particular cross involved *Malus floribunda* 821 and 'Rome Beauty'. In 1945, fruit breeders at the University of Illinois and Purdue University used two scab-resistant seedlings from the cross *M. floribunda* 821 x 'Rome Beauty' to begin the present apple disease-resistance breeding program. The cooperative program later included Rutgers University until 1987. Through these efforts, successful progress in breeding for disease resistance has been made, and thousands of resistant seedlings have since been evaluated for fruit quality, maturity, appearance, yield, and other horticultural characteristics. The following disease-resistant apple cultivars have been released.

'Prima'

'Prima', the first cultivar, was released in 1970. The PRI prefix is an acronym formed from the names of the three universities: Purdue, Rutgers, and Illinois. The original seedling was planted in Urbana in 1958, and the tree first bore fruit in 1963. 'Prima' is an attractive, bright red fruit (yellow ground color with 80 percent red overcolor) with excellent dessert quality. It ripens about four weeks before 'Red Delicious' (late August or early September in Urbana). The characteristic rich flavor and

crisp texture are retained a month or more at 34°F (1°C). There is little tendency for the fruit to drop before maturity. The tree is spreading and vigorous and has moderate tolerance to fire blight.

'Priscilla'

'Priscilla', the second cultivar, was released in 1972. The name was chosen to honor Priscilla Hovde, wife of Frederick Boyd Hovde, the seventh president of Purdue University. The original seedling was planted in Lafayette, Indiana, in 1962 and bore first fruit in 1966. 'Priscilla' is a dessert quality apple that is crisp with an aromatic flavor. The attractive fruit has a light yellow ground color with a 90 percent red overcolor. Again, fruit does not drop before maturity. In Urbana, 'Priscilla' ripens about two weeks after 'Prima' or two weeks before 'Red Delicious' (mid-September). The tree is moderately spreading and vigorous. It has good tolerance to fire blight and moderate tolerance to powdery mildew.

'Priam'

'Priam', the third cultivar released from the program (1974), was named for the last king of Troy, the father of Paris. The fruit is too acidic for most American tastes so it has been released for growing in Europe, mainly in France. It is a fall dessert apple with a crisp texture and a pleasant flavor. The attractive fruit has a green-yellow ground color with a 90 percent bright red overcolor. The fruit ripens a week or two before 'Red Delicious' and can be stored for three months at 35°F (2°C).

'Sir Prize'

'Sir Prize', the fourth cultivar (1975), is the only yellow golden apple released from the breeding program. Although it has a large attractive fruit, its thin skin and susceptibility to bruises make it unsuitable for commercial orchards. It is very desirable for the home garden, however. 'Sir Prize' has a juicy flesh with excellent dessert quality. The original seedling was planted in Lafayette, Indiana, in 1955, and the tree first bore fruit in 1961. The tree is vigorous, produces good annual crops, and does not require thinning. 'Sir Prize' ripens at the same time as 'Golden Delicious'. 'Sir Prize' is a triploid and therefore it has a low pollen viability.

'Jonafree'

'Jonafree', released in 1979, is the program's fifth scab-resistant apple cultivar. It also marked a

departure from the PRI designations. The original seedling was planted in Urbana in 1965, and the tree bore first fruit in 1972. 'Jonafree' ripens at the same time as 'Jonathan' and is very similar to 'Jonathan' in appearance and flavor. The attractive, glossy red fruit (95 percent red overcolor) has a crisp, juicy flesh. The tree is much less susceptible to fire blight and powdery mildew than is 'Jonathan'.

'Redfree'

'Redfree', released in 1981, is the program's sixth cultivar. This apple has an attractive red color and a crisp, juicy flesh. It is a high-quality summer apple with a firm flesh, and it does not drop easily from the tree. It retains its quality and firmness up to two weeks after maturity. When kept in cold storage, this apple can retain its quality up to two months. The original seedling was planted in 1966, and the tree bore first fruit in 1971. 'Redfree' matures two to three weeks before 'Prima' and six to seven weeks before 'Red Delicious' (early August). This apple appears to have broad climatic adaptation. The tree does not require fruit thinning. It has a semi-upright growth habit and sets good annual crops. The tree has moderate tolerance to fire blight and powdery mildew.

'Dayton'

'Dayton', released in 1988, is the program's seventh cultivar. It was named in honor of Daniel F. Dayton, emeritus professor and longtime leader of the disease-resistant apple breeding program at the University of Illinois. The original seedling was planted at Urbana, Illinois, in 1969, and the tree bore first fruit in 1976. The fruit ripens at the same time as 'Prima' and about four weeks before 'Red Delicious'. The fruit is large and has an attractive glossy red color; it is well distributed on the tree and can hang for up to two weeks while retaining its quality and texture. 'Dayton' can be stored for one month at 34°F (1°C) without losing its quality. The tree has strong branches and an upright growth habit, making it easy to train and prune. 'Dayton' has very good resistance to mildew and cedar rust and moderate resistance to fire blight.

'Williams' Pride'

'Williams' Pride', released in 1988, is the eighth cultivar to be released by the program. It was named in honor of Edwin B. Williams, emeritus professor and longtime leader of the disease-resistant apple program at Purdue University. The original seedling

was planted at Lafayette, Indiana, in 1975, and the tree bore first fruit in 1979. The fruit is glossy and attractive with a greenish yellow ground color and a 75 to 90 percent dark purple-red overcolor. The tree is an open-spreading spur type with moderately heavy crops. It has a tendency for biennial bearing; fruit thinning is recommended to offset this characteristic. Fruit ripens four weeks before 'Prima' and eight weeks before 'Red Delicious' and will retain its quality in storage for up to six weeks at 34°F (1°C). The tree is field immune to cedar rust with good resistance to mildew and very good resistance to fire blight.

'McShay'

'McShay' was released in 1988 in cooperation with Oregon State University. This scab-resistant apple was released for Oregon growing conditions. 'McShay' is a red apple (80 percent overcolor) with a juicy, fine-grained flesh. The fruit holds its good quality and texture for two months or more in cold storage. It ripens two weeks before 'Jonathan'. The tree is upright and vigorous and has good tolerance to powdery mildew.

All of these apple cultivars are available for purchase through various fruit nurseries around the United States except for 'Priam', which is sold mainly in France.

Several disease-resistant apple cultivars will be released in the next few years, and hundreds of selections are being tested.

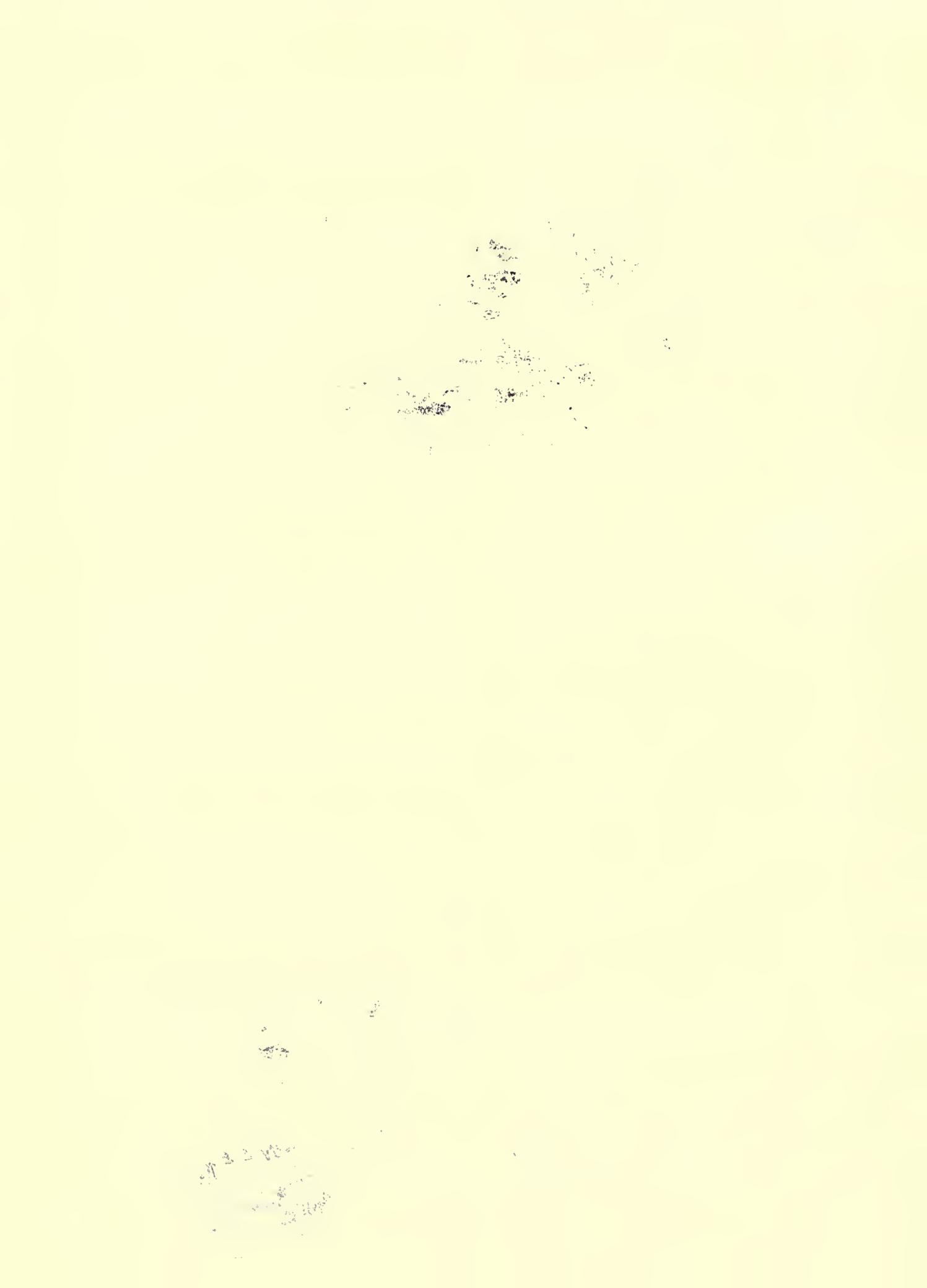
Maturity Date and Color of the Disease-Resistant Apple Cultivars

| Cultivar ^a | Maturity relative to | | Color of fruit |
|-----------------------|----------------------|----------|-------------------|
| | Delicious | Jonathan | |
| weeks | | | |
| Prima | -4 | -3 | red |
| Priscilla | -2 | -1 | red |
| Priam | -1½ | -½ | red |
| Sir Prize | 0 | +1 | yellow |
| Redfree | -7 | -6 | red |
| Jonafree | -1 | 0 | red |
| Dayton | -4 | -3 | red |
| Williams' Pride | -7 | -6 | red |
| McShay | 3 | -2 | red |

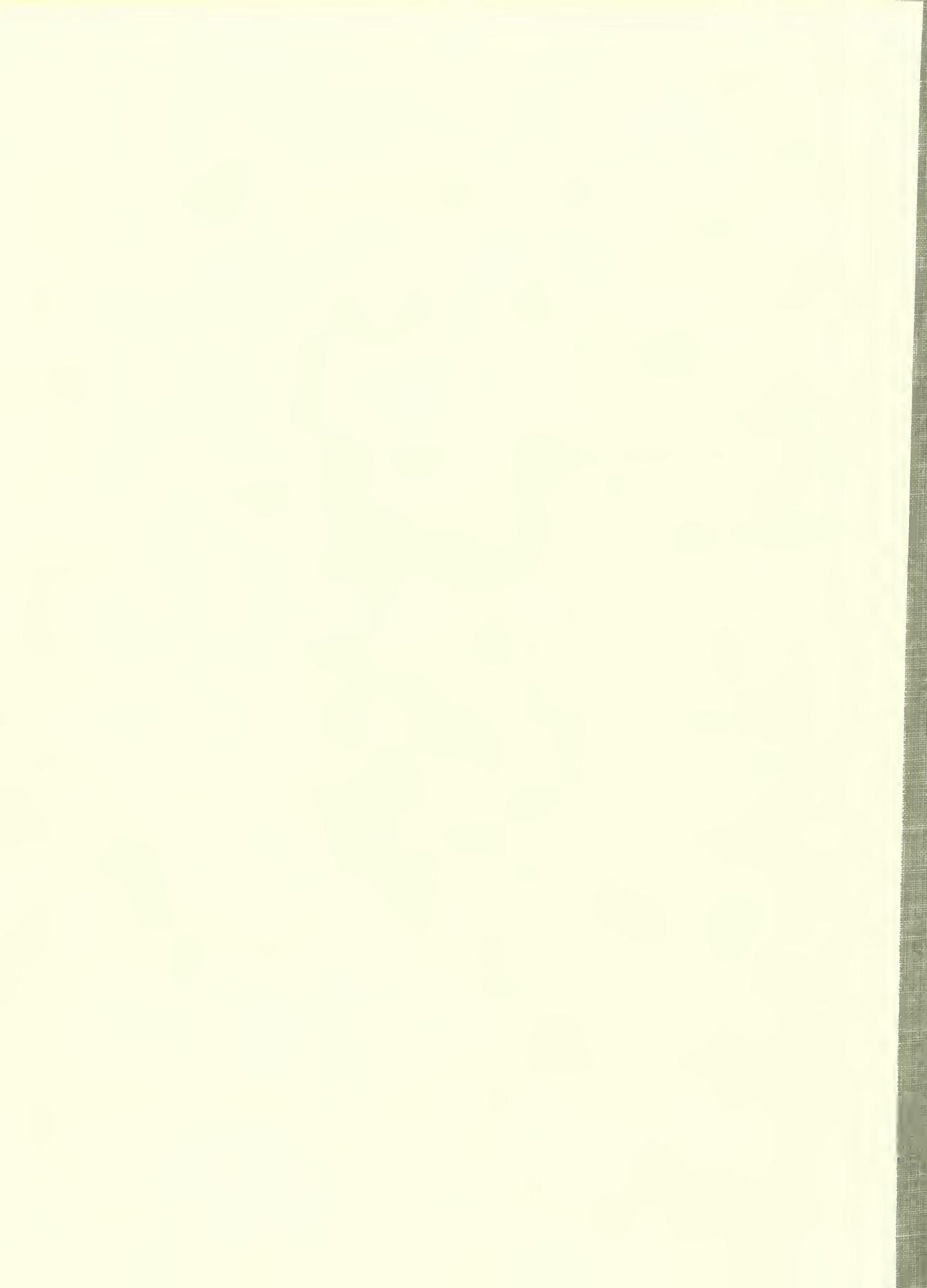
^a All of the cultivars have been bred and developed in cooperation with Purdue and Rutgers Universities. 'Priam' was released in cooperation with Institut National de la Recherches Agronomique (INRA), France; 'McShay' was released in cooperation with Oregon State University.

Prepared by S.S. Korban, associate professor of plant genetics, and P.A. O'Connor, research specialist in agriculture, both with the Department of Horticulture, University of Illinois at Urbana-Champaign.

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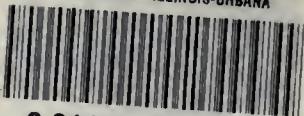








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